

NASA TECH BRIEF



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Damping of Thermoelastic Structures

A report is available which ascertains the effects of thermoelastic damping on the propagation of longitudinal waves in cylindrical rods. A review of classical results of wave propagation in unbounded elastic solids and in elastic cylinders precedes consideration of thermal modification of elastic properties. Effects upon the purely elastic wave motion consist of a change in propagation velocity and addition of a damping effect upon the mechanical energy of the elastic wave due to heat conduction.

This report shows and concludes that thermoelastic effects on an assigned frequency wave are small in terms of the propagation velocity. However, in comparison, the thermoelastic damping effect is large for very high frequency waves traveling in small diameter bars. There is a linkage of the behavior of the thermoelastic damping coefficient to the "thermoelastic bar number," $d\nu\chi$, where d is a thermoelastic material

constant; ν is Poisson's ratio; and χ is reduced frequency. Developed approximations, based upon the value of the thermoelastic bar number, predict the behavior of the thermoelastic damping coefficient as a function of frequency.

Notes:

1. Research engineers may use this work as a basis for investigating thermoelastic effects on other structural elements.

2. Documentation is available from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Price \$3.00

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